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ABSTRACT

A method for measuring recognition memory (free of distractors) and false recognition was based on the assumption that the subject was "honest." A distractor-free test of word recognition (a single-item test trial in which the 36 targets were presented prior to the 36 distractors) was compared with a traditional target-distractor discrimination test (a single-item test trial in which an equal number of targets and distractors were randomly ordered). The study results indicated that tests of recognition memory do not require distractors. Data suggested distractors may have encouraged "dishonesty" rather than prevented it. The observation was made that the number of false recognitions under the target distractor discrimination test was greater than that under the target-free test. The results of the present study were compared to a previous study conducted by Wallace, Sawyer, and Robertson (1978). The populations of words from which the test items were chosen differed. The earlier experiment was based on individual testing procedures, while the current study was a group testing procedure. (DWH)

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A Distractor-free Test of Recognition and a Target-free Test of False Recognition

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Abstract

A distractor-free test of word recognition (a single-item test trial in which the 36 targets were presented prior to the 36 distractors) was compared with a traditional target-distractor discrimination test (a single-item test trial in which the 36 targets and 36 distractors were randomly ordered). Contrary to the long-standing assumption that distractors are necessary in tests of recognition in order "to keep the subject honest," the distractor-free test resulted in almost identical recognition performance (hits and serial-position frequency patterns) with that of the conventional target-distractor discrimination test for both high- and low-frequency words. The larger number of false recognitions under the target-distractor discrimination test, as compared with a target-free test, was interpreted as evidence which suggests that distractors may encourage "dishonesty" rather than prevent it. Although there were no differences between the number of high- and low-frequency words recognized, more high-frequency than low-frequency words were recalled.

A Distractor-free Test of Recognition and a Target-free Test of False Recognition

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Wallace (1980) has made an interesting methodological distinction between recognition-discrimination memory (the traditional measure of recognition in which target items are tested in the context of randomly dispersed distractors) and recognition memory (the infrequently used measure of recognition in which target items are tested in the absence of distractors, e.g., Tulving & Watkins, 1973; Underwood, 1972; Wallace, 1978; Wallace, Sawyer, & Robertson, 1978). This distinction is important for practical and theoretical reasons because it provides operational definitions which separate clearly the general common-language conception of recognition (knowing or feeling that a present object has been met before) from the limited conception of recognition contrived by experimental psychologists (discriminating between targets and distractors).

The importance of this distinction may have been obvious for a long time, but the assumption that tests of recognition must include distractors in order to keep the subject honest (e.g., Baddeley, 1976; Crowder, 1976; Klatzky, 1975; Woodworth, 1938) may have inhibited investigators from studying pure recognition memory, and encouraged instead the study of synthetic recognition-discrimination memory. The effect of this assumption in directing the course of research in memory is great, but its effect on misdirecting the course of research may be even greater.

As Wallace (1980) concludes in the final paragraph of his essay:

> A requirement for including distractors on recognition tests is simply not essential to the concept of recognition memory. At present, the estimates of an individual's capacity to recognize a prior experience are determined to a large extent by the experimenter's decisions regarding the number of distractors and the nature of distractors. For the recognition memory implied by the description of knowing or feeling that the present object has been experienced before, test distractors are conceptually irrelevant and procedurally unnecessary. Even worse, their protracted use may be limiting the full understanding of recognition memory. (p. 702, italics in original)

This conclusion is based in part on the results of experiments (Wallace, 1978; Wallace, Sawyer, & Robertson, 1978) in which the number of target words recognized following the conventional recognition-discrimination procedure (study trial followed by a target-distractor discrimination-test trial) did not differ from the number of words recognized when the test trial did not contain distractors. These results obtained for both high- and low-frequency words, and regardless of whether or not the subjects were instructed that all the test words were on the study list.

Although the effects of distractor variables are of interest

in their own right, primarily in their potential for producing false recognitions, the distractor-free tests of recognition used by Wallace et al precluded the measurement of false recognitions and thus limited their scope exclusively to recognition. The purpose of the present article is to present a method for measuring both recognition memory (a count of correctly identified targets free of distractors) and false recognition (a count of distractors incorrectly identified as targets). The method is based on the underlying assumption that the subject is honest. If a test of recognition free of distractors yields scores which are comparable to those yielded by a test which uses distractors, then will a test of false recognition free of targets yield scores which are comparable to those yielded by a test which includes targets?

The empirical answer to this question was obtained by comparing the recognition and false recognition scores from a conventional recognition-discrimination test of memory (a study list of targets followed by a test list consisting of the targets randomly mixed with distractors) with the recognition and false-recognition scores from an unconventional distractor-free recognition test of memory (a study list of targets followed by a test list in which all of the targets are presented and responded to prior to the presentation of the distractors). This simple segregated arrangement of targets and distractors of the unconventional test requires only that each item on the test list be presented one at a time and that the subject be required to respond "old" or "new" during the single presentation of the test list. (Ley & Karker, Note 1, found that for the same list of targets and distractors, single-

item tests and multiple-item tests result in equivalent recognition and false-recognition scores.) If this single-item test procedure is followed, the subject shall have responded to all of the targets before having seen any distractors, thus precluding any effects of discrimination which might result from distractor variables.

Although the testing procedure described here allows for the test of recognition to have an effect on false recognitions (if there is any effect), this potential effect can be evaluated by comparing false recognition scores obtained by the method described here with a control group in which the order of targets and distractors on the test list is reversed, i.e., all the distractors are presented for identification before the targets.

In addition to the presentation of a method for measuring both recognition memory free of distractors and false recognition, the present study also provides a replication of part of Wallace, Sawyer, and Robertson's (1978) test of the word-frequency effect on measures of distractor-free recognition and on recall. In the present study, separate lists of high- and low-frequency words were selected from Ley and Tesiny's (1975) norms, and used under both recognition and free-recall conditions. Aside from different lists of words presented in a multiple-item test format, Wallace, Sawyer, and Robertson tested their subjects individually, whereas the subjects of the present study were tested in relatively large intact groups, a condition in which the subject's anonymity was assured, thus increasing the risk of "dishonesty."

Experiment I

The primary purpose of this experiment was to compare recognition scores from distractor-free tests of recognition with scores obtained from conventional target-distractor discrimination tests. The comparisons involved two separate lists of targets: one composed of high-frequency words, the other of low-frequency words.

The secondary purpose of the experiment was to compare false-recognition scores from a target-free test with those obtained from the conventional target-distractor discrimination test. The target-free test consisted of the presentation of the distractor items after all of the targets of the distractor-free test had been presented and responded to. In order to evaluate the potential effect of the distractor-free test of recognition on the subsequent target-free test of false recognition, a target-free-control test was used. This control test was the same as the target-free test except that the recognition test did not precede it, thus precluding any potential effect of target identification on false-recognition scores.

Method

Subjects. The subjects, 129 students at the State University of New York at Albany, were unpaid volunteers recruited from two undergraduate History classes, one of which (N = 81) was used for the testing of high-frequency words, the other (N = 48) for low-frequency words. The recruitment and testing took place at the beginning of regularly scheduled class periods. Both classes were tested during the same week.

Materials and procedure. The recognition test for high-

frequency words used 76 common English-language words (36 targets, 4 buffers, 36 distractors) selected at random from the upper third of Ley and Tesiny's (1975) norms of words and paralogs assessed for associative frequency (a'). The recognition test for low-frequency words used 76 uncommon words (36 targets, 4 buffers, 36 distractors) selected at random from the lower third of the same set.

The study trials of the recognition procedure for high- and low-frequency words were the same. The 36 targets and four buffers of either the high- or low-frequency lists were displayed on a film screen via a Kodac Carousel slide projector, one word per slide at a four-sec. presentation rate controlled by the internal timer of the projector. Two of the buffers were displayed before the list of 36 targets and two after.

During a two-minute period which intervened between the study and test phases, the subjects were instructed to perform simple arithmetical computations--the multiplication of three-digit numbers by three-digit numbers.

Prior to the study phase, sealed test booklets were distributed to each subject, after which the experimenter read aloud the detailed instructions which in essence, told the subjects that the experiment consisted of three phases: (1) a study phase, in which they would see a list of words to be remembered, each word presented one at a time, (2) a computational phase, in which they would be required to do some multiplication exercises, and (3) a test phase, in which they would find in their sealed booklets a single word in the middle of each page with the words "old" and "new" in the bottom corners of each page, and that if the word

in the middle of the page was one they remembered seeing during the study phase, they should encircle the word "old," and if it was not, they should encircle the word "new." The subjects were also instructed to go through the booklet once in a sequential order beginning with the first page, and not to refer back to previously marked pages.

The study booklets consisted of three different formats, that is, three different arrangements of targets and distractors. One third of the booklets (the distractor-free test) contained the 36 targets on the first 36 pages of the booklet and the 36 distractors on the last 36 pages. A second third contained a random mix of targets and distractors (the target-distractor discrimination test) with the single restriction that the order of the targets and distractors be the same as that of the distractor-free test. And a third third (a target-free control test of false recognition) contained the 36 distractors on the first 36 pages and the 36 targets on the last 36 pages of the booklet, with the order of distractors and targets the same as that in the other two formats. There were no time restrictions during the testing phase, but all subjects completed the test booklets within five minutes.

Results

The mean number of hits (correctly identified high- and low-frequency target words) for the distractor-free and target-distractor discrimination tests of recognition are given in Table 1. A cursory examination of these data makes it clear that the

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Insert Table 1 about here

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distractor-free test yields virtually identical scores to those obtained under the conventional target-distractor discrimination test. This equivalence of scores applies to both high- and low-frequency words. The analysis of variance for the Test variable gave $F(1, 85) = .134$, $p > .05$, $MSe = 31.5976$.

Furthermore, these data are remarkably similar to those of Wallace, Sawyer, and Robertson's (1978) Experiment II. Since Wallace et al used 50 targets in their recognition tests as compared with 36 in the present study, the mean hits from their study and the mean hits from the present study were converted into proportion scores by dividing mean hits by the total number of targets of their respective lists. The proportions for both studies are given in Table 2. Although the proportions of hits

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Insert Table 2 about here

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of high-frequency words are about the same for both studies, the proportions of hits of low-frequency words are different. In the present study, the mean number of low-frequency words correctly identified ($M = 28.31$) was not significantly greater than the mean number of high-frequency words ($M = 28.14$) [$F(1, 85) = .071$, $p > .05$], whereas in the Wallace et al study, more low-frequency words were recognized than high-frequency words. The negligible Test X Frequency interaction of the present study [$F(1, 85) = .21$, $p > .05$] makes it clear that the minuscule difference between the mean number of low- and high-frequency hits ($D = .09$) was not the result of offsetting differences between the distractor-free and target-distractor discrimination

test with respect to high- and low-frequency words.

Additional evidence of the comparability of the distractor-free and target-distractor discrimination tests is given in Figure 1, a plot of the serial-position curves for the proportions

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Insert Figure 1 about here

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of high-frequency hits for each test. Although neither curve shows a strong serial-position effect, both curves follow the same general pattern, and each suggests a primacy effect.

The serial-position curves for the low-frequency hits (see Figure 2) show no evidence of a serial-position effect, but both

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Insert Figure 2 about here

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curves (the distractor-free and the target-distractor discrimination tests of low-frequency words) follow the same distinct pattern. Whatever the variables which account for the differences in the recognizability of the targets, both tests appear to be equally sensitive to them.

The mean number of false recognitions of high- and low-frequency words under the target-free and target-distractor discrimination tests are given in Table 3. The analysis of

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Insert Table 3 about here

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variance of these data revealed that the mean number of false recognitions under the target-distractor discrimination test

(M = 7.05) was significantly greater than the mean number under the target-free test (M = 4.60), $F(1, 85) = 5.25$, $p < .025$, MS_e = 18.3425. The analysis also showed that the mean number of false recognitions of low-frequency words (M = 7.82) was significantly greater than the mean number for high-frequency words (M = 3.84), $F(1, 85) = 17.34$, $p < .001$. The Test X Frequency interaction was not significant, $F(1, 85) = 1.85$, $p > .05$.

Since the false-recognition scores under the target-free test may have been affected by the test of recognition which preceded the test of false recognition, comparisons were made with the results of a target-free-control test of false recognitions (the test in which the 36 distractors were given before the 36 targets). The statistical analyses of these comparisons showed that for high-frequency words, the mean number of false recognitions under the control test (M = 3.52) was not significantly different from the mean number under the target-free test (M = 3.26), $t(52) = .20$, $p > .05$. However, for low-frequency words, the mean number of false recognitions under the control test (M = 11.56) was significantly greater than the mean under the target-free test (M = 5.94), $t(30) = 3.27$, $p < .01$. It appears, therefore, that the effect of the distractor-free test of recognition is limited to the false-recognition rate of low-frequency words. (The differences between the mean number of false recognitions under the control and target-distractor discrimination tests for high-frequency words, $D = 3.52 - 4.41 = -.89$, and low-frequency words, $D = 11.56-9.69 = 1.87$, were not significant; $p > .05$ in each case.)

Experiment II

Although the distractor-free test of recognition resulted in a hit rate almost identical to that of the conventional target-distractor discrimination test, a finding which supports Wallace's (1980) thesis, the number of low-frequency words recognized was not greater than the number of high-frequency words, a finding which is not consistent with those of Wallace, Sawyer, and Robertson's (1978) Experiment II. Furthermore, the absence of a facilitative effect of low-frequency on recognition is not consistent with the generally held principle that a distinction between recognition and recall is the opposite effect of word frequency, i.e., the frequency paradox (cf. Gregg, 1976): low-frequency words are better recognized than high-frequency words, but high-frequency words are better recalled than low-frequency words.

Since it might be argued that the sample of words used in Experiment I was not truly representative of high- and low-frequency words, Experiment II was conducted to determine whether the word-frequency effect would obtain for the free recall of this sample. That is, would more high-frequency words of the list used in Experiment I be recalled than low-frequency words of the list from this experiment?

Method

Subjects. The subjects, 87 unpaid student volunteers at the State University of New York at Albany, were recruited in the same manner as in Experiment I. One undergraduate class in Geology (N = 28) was used for testing the high-frequency

words, and one undergraduate class in History (N = 59) was used for testing the low-frequency words.

Materials and procedure. The study trials of the present experiment used the same materials and followed the same procedures as those of Experiment I (the same high- and low-frequency words were presented in the same order at the same presentation rate); only the test trials differed. Standard free-recall instructions were given in which the subjects were told to write on a sheet of paper provided by the experimenter all the words they could remember from the study list. There were no time restrictions, but all subjects in both the high- and low-frequency-word groups completed their tasks within about three minutes.

Results

Consistent with the customary effect of word frequency on free recall, the mean number of high-frequency words recalled (M = 8.18) was significantly greater than the mean number of low-frequency words (M = 4.47), $t(85) = 6.29$, $p < .001$. In order to compare these results with those of Wallace, Sawyer, and Robertson (1978), the means cited above were converted into proportions (mean words recalled/36), as were the means reported by Wallace et al (mean words recalled/50), and are given in Table 4. It is clear that the results of the recall tests of

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Insert Table 4 about here

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both high- and low-frequency words of these separate experiments are almost identical.

Additional evidence which supports the validity of the frequency assessments of the words of the lists of the present study can be seen in the typical serial-position effects in the curves of Figure 3. (Both curves include the four buffers of their list).

Insert Figure 3 about here

Discussion

The findings of the present study support Wallace's (1980) thesis that tests of recognition memory do not require distractors. The virtually identical mean recognition scores under the distractor-free and target-distractor discrimination tests make it clear that distractors are not necessary in order "to keep the subject honest."

Perhaps a more surprising finding is the data which suggest that distractors, contrary to their intended purpose, may encourage "dishonesty" rather than provide a safeguard against it. This contention is based on the observation that the number of false recognitions under the target-distractor discrimination test was greater than that under the target-free test for both high- and low-frequency words. Since the subject can not have memory for an event which did not occur, the false-recognition error rate is a potential expression of "dishonesty" (i.e., claiming to recognize a word when in fact one can not). Thus, distractors aren't necessary "to keep the subject honest," but they may be necessary to tempt the subject into "dishonesty." It may be important to note that this argument is not based on an all-or-none assumption of recognition certainty. Allowing that there are differences in the degree of feelings of certainty the subject experiences on seeing a target or a distractor during a

test trial, the fact remains that the conventional target-distractor discrimination test generated more false recognitions than the target-free test which followed the distractor-free test of recognition.

As for the word-frequency effect, although more high-frequency words were recalled than low-frequency, there was no difference between the number of high- and low-frequency words recognized. The reason for the absence of a frequency effect is not clear, but two methodological differences between the present experiment and Wallace, Sawyer, and Robertson's (1978) Experiment II provide terable hypotheses.

One hypothesis is based on the populations of words from which the samples of the two experiments were chosen. While Wallace et al selected their words from Thorndike and Lorge's (1944) list, a list based on a count of the frequency of occurrence of the words in the written language, the words of the present study were selected from Ley and Tesiny's (1975) list, a list in which the assessment of associative frequency is based on responses of individual subjects. Although both lists may be highly correlated, subtle differences in assessment procedures can have a strong effect on the memorability of words in a variety of experimental paradigms (e.g., Ley, 1968; Ley, 1977; Ley & Dean, 1973).

A second hypothesis is based on the individual testing procedures of Wallace et al versus the group testing procedures of the present experiment. Although there seems to be little reason to supposed that the students of one undergraduate class in History are better or poorer on a simple word recognition task than the

students of another undergraduate class in History at the same university, it is conceivable that such differences exist. Individual differences in memory among college students at the same university are not unheard of (e.g., Dean & Ley, 1977). Whatever the explanation for the absence of the word-frequency effect, it should be noted that this anomaly has no bearing on the clear-cut findings from the comparisons of the distractor-free and target-distractor discrimination tests.

Reference Note

1. Ley, R. & Karker, J. Measures of short-term recognition memory. Paper presented at the annual meeting of the Psychonomic Society, St. Louis, Missouri, November, 1973.

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Table 1

Mean Number of High- and Low-Frequency Words Correctly Identified (Hits) Under Two Tests of Recognition

	Test of Recognition		
Word Frequency	Distractor-Free	Target-Distractor Discrimination	Grand Mean
High	28.59	27.70	28.14
Low	28.12	28.50	28.31
Grand Mean	28.36	28.10	

Table 2

Mean Proportions (Hits/Total Targets) of High- and Low-Frequency Words Under Two Tests of Recognition of Present Study and Wallace, Sawyer, and Robertson's (1978) Experiment II

	Wallace et al Experiment II		Ley's Experiment I	
Word Frequency	Distractor-Free	Target-Distractor Discrimination	Distractor-Free	Target-Distractor Discrimination
High	.75	.73	.79	.77
Low	.87	.87	.78	.79
Grand Mean	.81	.80	.79	.78

Table 3

Mean Number of False Recognitions of High- and Low-Frequency Words Under Two Tests of Recognition

Word Frequency	Test of Recognition: Target-Free	Test of Recognition: Target-Distractor Discrimination	Grand Mean
High	3.26	4.41	3.84
Low	5.94	9.69	7.82
Grand Mean	4.60	7.05	

Table 4

Mean Proportions of Words Recalled in the Present Experiment and in Wallace, Sawyer, and Robertson's Experiment II

Word Frequency	Wallace et al Experiment II	Ley's Experiment II
High	.21	.23
Low	.12	.12
Grand Mean	.16	.17

Figure Captions

Figure 1. Serial-position curves of the proportions of high-frequency words recognized (hits) under the distractor-free and target-distractor discrimination tests.

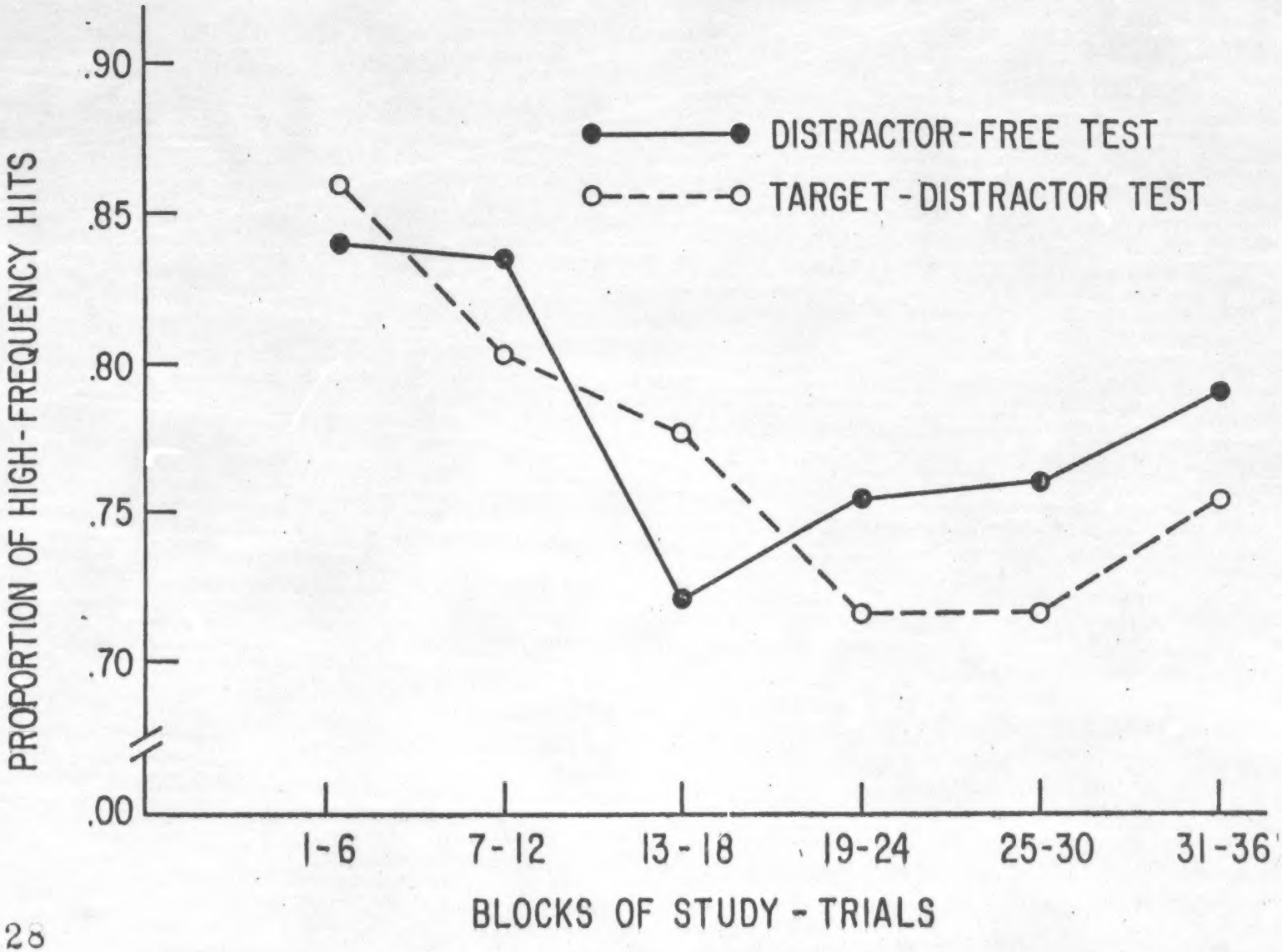
Figure 2. Serial-position curves of the proportions of low-frequency words recognized (hits) under the distractor-free and target-distractor discrimination tests.

Figure 3. Serial-position curves of the proportions of high- and low-frequency words recalled.

Footnotes

1. This research was supported in part by a grant-in-aid from the Research Foundation of the State University of New York.

2. Requests for reprints should be sent to Ronald Ley, State University of New York at Albany, 1400 Washington Avenue, Albany, New York 12222.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PROPORTION OF HIGH-FREQUENCY HITS
DISTRACTOR-FREE TEST
TARGET-DISTRACTOR TEST
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13-18
19-24
25-30
31-36
BLOCKS OF STUDY-TRIALS

28

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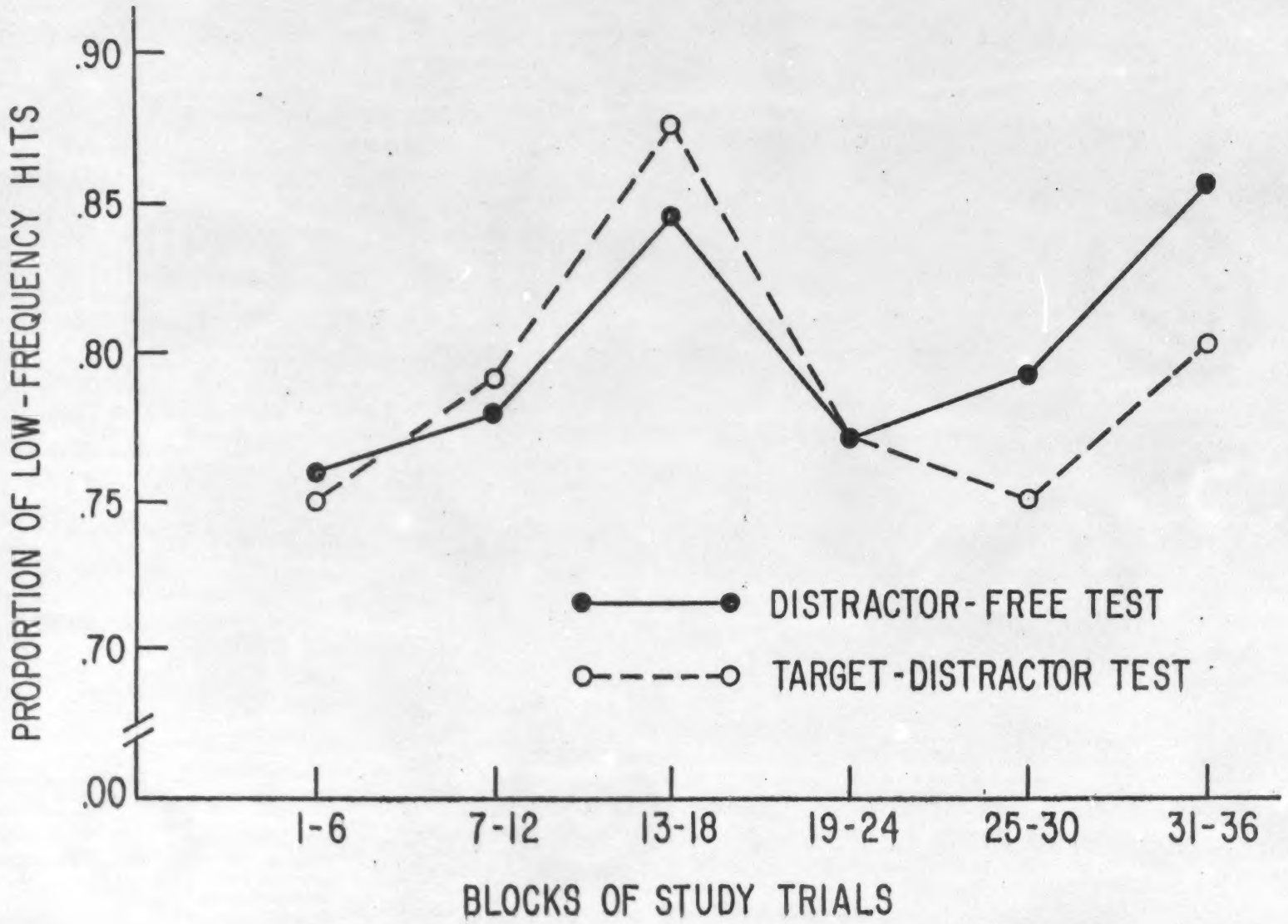
Fig. 1


PROPORTION OF LOW-FREQUENCY HITS
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BLOCKS OF STUDY TRIALS
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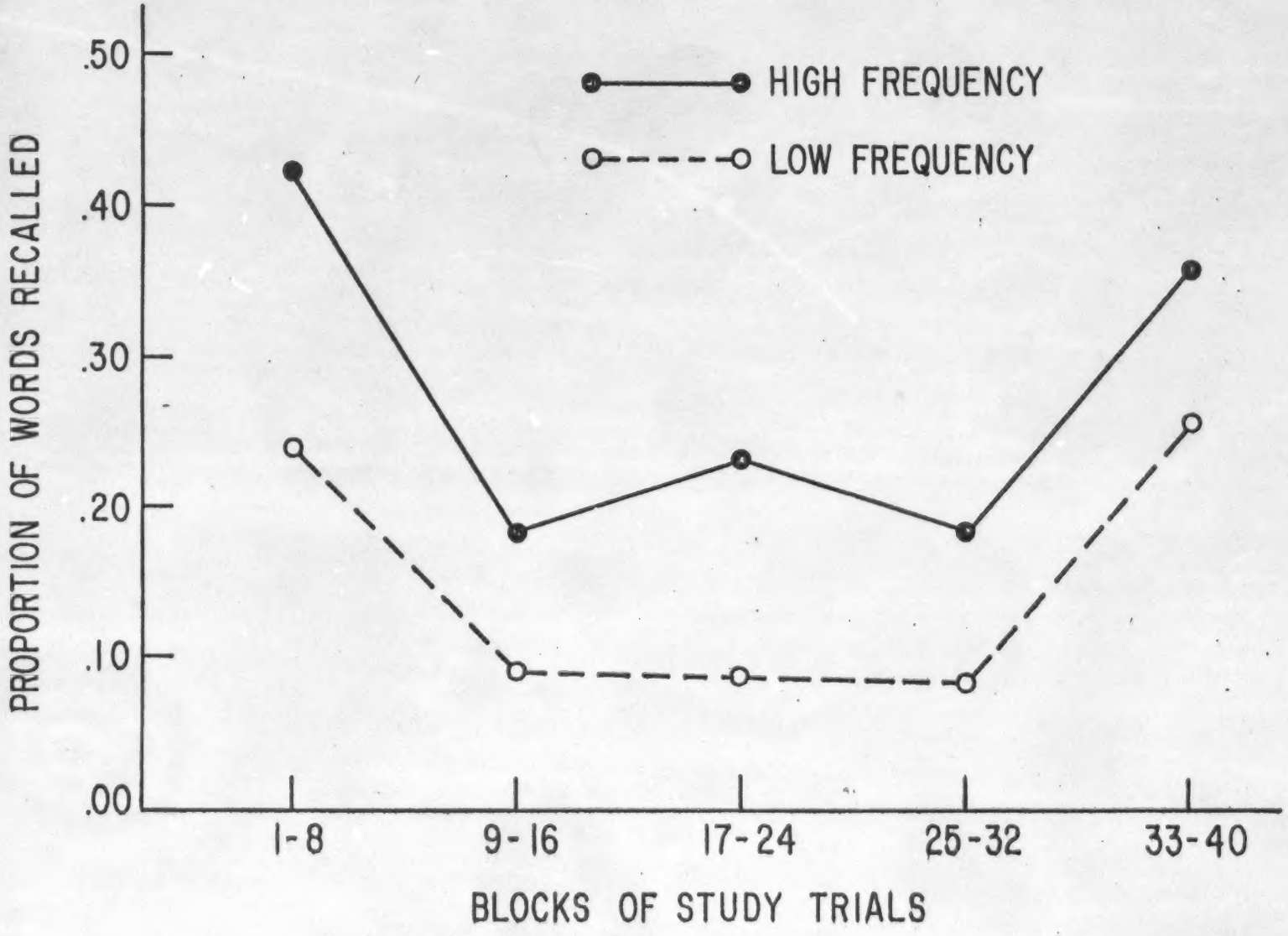
TARGET-DISTRACTOR TEST

Fig. 2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PROPORTION OF WORDS RECALLED
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BLOCKS OF STUDY TRIALS